

**Vehicle seat having a massage function  
and contour adjustment****10/527740**BACKGROUND AND SUMMARY OF THE INVENTION

[0001] This application claims the priority of German patent document 102 42 760.7, filed September 14, 2002 (PCT International Application No. PCT/EP2003/009916, filed September 6, 2003) the disclosure of which is expressly incorporated by reference herein.

[0002] The invention relates to a vehicle seat which is equipped with an arrangement for performing massage functions.

[0003] Vehicle seats of motor vehicles have at least one seat cushion and a seat back which are provided with a predetermined seat contour by means of cushion elements and respective spring systems. The construction of vehicle seats of this type conventionally comprises an underspringing arrangement which is covered by cushion pads and then by a seat cover. The upholstery and the fastening seams of the seat cover are designed to provide a seat contour that minimizes fatigue symptoms for the driver of the motor vehicle, even during prolonged sitting, and is adapted as well as possible to the anatomy of the particular driver. For this purpose, it is known to provide vehicle seats with one or more pneumatic elements which (via a controller and a pressure generator), make it possible for the seat contour to be optimally adapted to a particular driver. A disadvantage of these relatively large

pneumatic elements is that adjustment of the seat contour is limited because of the relatively thick-walled cushion pads of the backrest and of the seat cushion.

**[0004]** Furthermore, it is known, especially in truck seats, to provide pneumatic elements in the seat, which elements can be pressurized via a control device in such a manner that various massage functions can be realized via the pneumatic element. By this means, in a manner similar to the massage pads of vehicle seats consisting of beads, a periodically changing seat contour can be produced in such a manner as to prevent symptoms of fatigue due to sitting for a long time in the vehicle seat. A disadvantage of this arrangement is that either the pneumatic elements produce only a small effect (since they are generally connected to one another pneumatically and therefore in a pressure-related manner), and/or the massage effect is relatively weak. Even in the case of a relatively large pressure below the cushion pad of vehicle seats, because the covers are generally fastened in a fixed position above this cushion pad, an effective transmission of pressures to the body of the driver is.

**[0005]** German patent document DE 43 31 663 C1 discloses the integration of a plurality of cushion-like air cushions, which are small in relation to the surface of the seat contour, in a vehicle seat, which air cushions can be pressurized in a specific manner by means of a controller in order to influence the seat contour and, as a result, to obtain different massage effects. The precise arrangement of the air cushions within the seat cushion and the seat back is not explained.

**[0006]** JP 60 154 925 A also discloses a vehicle seat, in which numerous small air cushions are embedded in the cushion can be activated via separate lines to change the seat contour.

**[0007]** Finally, U.S. Patent Nos. 4, 655,505 and 5,155,685 disclose vehicle seats, in which small air cushions are arranged within the cushion.

**[0008]** Therefore, one object of the present invention is to provide a vehicle seat of the type described above, in which the pressurizable elements are arranged within the seat as effectively as possible with regard to the desired seat contour.

**[0009]** This and other objects and advantages are achieved by the vehicle seat according to the invention, in which the seat cushion and seat back are each provided with a plurality of pressurizable elements for adjusting the seat contour. A controller controls the pressurization of the respective elements so that different massage effects can be obtained. The pressurizable elements are cushion-like elements which are small in relation to the surface of the seat contour, and can each be activated separately via lines in order to change the seat contour in an essentially punctiform or localized manner. This permits an effective massage function to be realized by means of the pressurizable elements, since a localized or punctiform generation of pressure makes changes to the seat contour possible in a specific manner.

**[0010]** Because the pressurizable elements are relatively small, cushion-like elements, the required volume is small and the response time is therefore low. The massage function can be fitted on existing seats, requiring only a small additional amount of space. The merely punctiform generation of pressure of individual

elements or of a combination of a plurality of pressurizable elements is surprisingly sufficient for a specific change to the seat contour and for effective realization of massage functions. Although there is only a small volume of the pressurizable elements, the point-type increase in pressure within the seatback and the seat of the vehicle makes it possible, in conjunction with the seat contour (which comprises a lining and/or upholstery and cover) to change the seat contour in a specific and effective manner.

**[0011]** The pressurizable elements are arranged between the upholstery and the cover of the vehicle seat, increasing the effectiveness of the essentially punctiform or localized generation of pressure by means of the pressurizable elements. For the purpose of the present disclosure, the phrases "essentially punctiform" and "localized" are understood as meaning a region which is relatively small in relation to the overall surface of the seat or of the seatback of the vehicle seat (in particular a region in the order of magnitude of 5 to 10 cm<sup>2</sup>), which is actuatable separately by means of an individual pressurizable element. The number and arrangement of the particular elements is preferably distributed essentially over the entire surface of the seat contour, but may also be limited to individual specific regions.

**[0012]** According to one embodiment of the invention, a desired, static seat contour can be set by means of the pressurizable elements and the controller of the vehicle seat. Building on this preset, static seat contour (*i.e.*, a seat contour which is defined by different pressurization of individual pressure elements), a massage function can be implemented simply and effectively, for example by periodic changing or combined actuation of individual pressure elements or of pressurizable

elements of an entire region (such as, for example, the dorsal vertebra region), and the seat contour which is specifically adapted to a driver, is readily resumed afterwards. Similarly preset seat positions for a plurality of users, as are occasionally already realized in motor vehicles nowadays, can thus adapt the vehicle seat to different users of the vehicle in a specific manner, *i.e.*, in accordance with the particular orthopedic and/or comfort-related conditions. According to the invention, the seat contour can always be retrieved again or is automatically resumed after one or more massage actions have been carried out. This advantageously takes place by pressurization of individual elements which each have only a small volume and accordingly have short response times. The contour adjustment according to the invention with a combined massage function is less space-consuming and can be fitted in a simple manner between the individual elements of a vehicle seat, in particular the underspringing arrangement, upholstery and the cover of the seat.

**[0013]** According to another embodiment of the invention, the pressurizable elements are fixed on a sheet-like support insert and are arranged below a lining of the vehicle seat, which lining is covered by the cover of the seat. This facilitates the assembly of the seat according to the invention, since the individual elements and their connecting lines are fixed on a support surface in such a manner that slipping or displacement during the production of the vehicle seat is avoided. The position of the particular pressure so that, in particular, even specific massages of individual locations in the region of the seat contour are possible.

**[0014]** According to a further embodiment of the invention, the shape of the pressurizable elements is such that localized pressure regions can be produced

within the seat contour. This avoids movement of the entire region of the seat cushion or of the backrest, or of at least a large part thereof, by actuation of a single element. Localized pressurization enhances the variability in the realization of presetting of the seat contour, as well as the diversity of the massage functions which can be realized by means of the seat.

**[0015]** A shape of the pressurizable elements which is essentially adapted to a localized generation of pressure regions is, for example, an oval or circular shape with lateral boundary seams, so that, when the element is pressurized, it expands essentially only in the direction transverse to the surface of the seat contour. Alternatively, the pressure element may have bellows-like side regions which are connected by sheet-like, opposite side walls so that a punctiform generation of pressure is possible. Here too, a pressure is generated essentially in the direction of the seat surface and of the backrest surface, without a significant enlargement of the element toward the sides, so that a sheet-like (not punctiform) generation of pressure takes place. Of course, it is also possible to use any other shape of the pressurizable element, so long as, in accordance with this aspect of the invention, an essentially punctiform pressurization (*i.e.*, pressurization which is specific and effective with regard to the massage action and the setting of desired seat contours) can be realized.

**[0016]** According to another embodiment of the invention, the pressurizable elements can be actuated via respective, separate lines that are arranged and fixed in the surface of a support insert, and are bunched together in the direction of the control element. This arrangement simplifies the installation of the pressure

elements and their associated lines during production of the vehicle seat, since a simple, sheet-like support insert is fitted and fixed in the layers of the seat. In addition, the connecting lines of the control device or of the pressure-generating device are thereby as short as possible, and the corresponding response times when pressurized are correspondingly short. The fixing in the surface of a support insert furthermore has the advantage that the amount of space required is reduced to a minimum in its vertical extent.

**[0017]** According to a further embodiment of the invention, the pressurizable elements can be pressurized pneumatically or electropneumatically. As an alternative, a pressurization by a fluid may also be provided, but the use of air is advantageous in respect of leakage problems.

**[0018]** According to a further embodiment of the invention, the controller is adapted to carry out a plurality of preset and individually settable massage functions. The massage functions are realized via a combined, periodically changing and/or individual actuation of the particular pressure elements in the regions of the seat contour. In particular, this makes it possible to implement known types of massage, such as, for example, a reflex zone massage with specific massage of individual regions of the body.

**[0019]** According to another advantageous refinement of the invention, a plurality of preselected settings of a seat contour can be stored by the controller. This makes it possible for a specific adaptation of the seat contour that is essential for prolonged driving to be stored for each different user of the vehicle, especially in the case of trucks. In a manner similar to preset seat positions (seat height,

backrest slope, distance from the pedals etc.), the particular seat contour can advantageously also be specifically adapted and also stored in this adaptation. All that the particular driver has to do is select the presetting that has been optimized for his body build, which is realized by the controller via the pressurizable elements.

[0020] Other objects, advantages and novel features of the present invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Figure 1 shows a perspective view of a first exemplary embodiment of a vehicle seat with pneumatic pressure elements according to the invention;

[0022] Figure 2 shows a schematic, cutaway side view of a vehicle seat of the exemplary embodiment from figure 1 in the relaxed state of the pressure elements;

[0023] Figure 3 shows the vehicle seat according to figure 2 with two pneumatic elements in the pressure state;

[0024] Figure 4 shows a variety of shapes of the pneumatic elements according to the invention; and

[0025] Figure 5 shows alternative embodiments, with differing shape and arrangement of the pressure lines, for the pneumatic pressure elements according to the invention.



## DETAILED DESCRIPTION OF THE DRAWINGS

[0026] Figure 1 is a perspective view of a first exemplary embodiment of a vehicle seat according to the invention with a combined massage function and contour adjustment. The vehicle seat 1 has a seat cushion 2 and a backrest 3 which are connected to each other in an articulated manner. Beneath its cover 8 vehicle seat 1 has a plurality of pressurizable elements or pneumatic elements 4 which can be actuated with air pressure by a pressure generating device (not shown) via respective connecting lines 6.

[0027] The pneumatic elements 4 preferably have a relatively small volume or surface expansion, so that an essentially localized generation of pressure is possible. In the exemplary embodiment shown, the shape of the pneumatic elements 4 is essentially oval or circular, so that small pressure pads or pressure cushions are formed in selected regions of the seat contour of the vehicle seat 1. (As an alternative, the entire seat contour may be provided with the pneumatic elements 4 illustrated.) The pneumatic elements 4 are fitted and fastened on a sheet-like support insert 9, so that their respective position within the surface of the seat contour is precisely established. In addition, this facilitates assembly. The controller 5 arranged in the region of the seat back 3 actuates the pneumatic elements 4 - on their own, in combination or in a consecutive time sequence. Each pneumatic element 4 is provided separately with the required air pressure by means of the controller via respective, separate connecting lines 6. Like the realization of specific seat contours, the massage function can thus be realized in an advantageous and

effective manner with a relatively small volume (*i.e.*, a relatively low pressure), in the medium or the compressed air.

**[0028]** Figure 2 schematically illustrates a lateral sectional view of the vehicle seat 1 according to the exemplary embodiment of the invention from Figure 1. The seat cushion 2 and the seat back 3 of the vehicle seat 1 each comprise in particular an underspringing arrangement 11, upholstery 7, a lining 10 and a cover 8 covering these elements. In this exemplary embodiment, the insert according to the invention of pneumatic elements 4 for a massage function and a contour adjustment of the seat is arranged between the upholstery 7 and the lining 10. The relatively small, separate pneumatic elements 4 are arranged in the vicinity of the surface of the seat contour of the vehicle seat 1 in such a manner that, with little pressure and a small volume, an adjustment of particular regions or points of the seat surfaces and backrest surfaces is possible. The controller 5 is preferably arranged in the region of the backrest 3, so that an additional amount of space is not required.

**[0029]** Figure 3 illustrates the exemplary embodiment of a vehicle seat according to the invention from Figure 2 in a similar view, but with two selected pneumatic elements 4 being pressurized. The two pressurized pneumatic elements 4 each produce a local bulge at the predetermined point, essentially without the entire contour of the vehicle seat being changed. That is, after pressurization of the two elements 4, it is ensured that the original seat contour is reached again. Similarly, the situation illustrated in figure 3 may be a preselected, specific seat contour for a specific driver who desires an elevation in the lumbar vertebrae region and in the

front seat surface region, for the optimum orthopedic adaptation or other type of adaptation to the body of this driver.

**[0030]** Figure 4 illustrates alternative embodiments of the pneumatic or pressure elements 4 according to the invention having differing shapes. The common feature of all such shapes is that they provide an essentially punctiform or localized pressurization. In addition, the elements 4 are relatively small in their volume and are also small in respect of their surface expansion with regard to the entire surface of the seat contour. Each pneumatic element 4 is provided with a connection line 6 via which the pressure is supplied and can be conducted away again. The shape variants which are illustrated and are given by way of example for the possibility of realizing a punctiform generation of pressure as follows: oval, eye-shape, laterally constricted concertina shape, two chamber shape, elliptical shape with bump like bulge and elliptical shape with a plurality of bump like formations. Of course, other shapes and variants may be suitable for the massage and the adjustment of the seat contour of a vehicle seat, as long as an essentially punctiform or localized generation of pressure which requires little space is possible with them.

**[0031]** Figure 5 shows two different embodiments of a design and arrangement of respective connection lines 6 to the individual pneumatic pressure elements 4 (not illustrated). The lines 6 of the first variant illustrated are cylindrical pipelines which are arranged and fastened on a support insert 9 and are brought together in a manner such that they are bunched together in the direction of the controller or pressure generating device (not illustrated). The fixing on the support insert 9 has the advantage of easier assembly, and the fastening on the surface of the support

insert 9 has the advantage of a low amount of space being required vertically. As an alternative, in the second variant embodiment illustrated, a plurality of channel like, cross-sectionally rectangular lines 6 are provided on the support insert 9 and can be realized, for example, by the welding together of a plurality of layers of film.

**[0032]** The foregoing disclosure has been set forth merely to illustrate the invention and is not intended to be limiting. Since modifications of the disclosed embodiments incorporating the spirit and substance of the invention may occur to persons skilled in the art, the invention should be construed to include everything within the scope of the appended claims and equivalents thereof.